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Vertebrate pollinators visit flowers of an Umbrella Tree *Schefflera actinophylla* almost exclusively in the afternoon

Don Franklin

Key Centre for Tropical Wildlife Management, Northern Territory University, Darwin, NT 0909. Email: don.franklin@ntu.edu.au

Abstract

Quantified observations of use of the flowers of a large cultivated specimen of the Umbrella Tree *Schefflera actinophylla* by potential pollinators show that the flowers were visited by a range of birds, and occasionally by a Black Flying Fox *Pteropus alecto*, but almost always in the afternoon from about 1400 hours until sundown. This pattern is consistent with previous and other anecdotal observations. There was no evidence of the characteristically noisy aggregations of flying foxes at the flowers at night. Most bird-pollinated flowers secrete nectar, and are visited by birds, in the morning or throughout the day. The apparently unusual pattern exhibited by this Umbrella Tree might be explained as a response to competition for pollinators, but further study is required to confirm the generality and significance of the pattern.

Introduction

Plants provide nectar as one of several possible rewards for the animals that effect their pollination. However, they do not do so indiscriminately. One of many parameters of nectar secretion that may be optimised to the plant's needs is its timing so that availability corresponds with and/or manipulates the activities of pollinating agents. The flowers of plants specialised for pollination by birds typically open and/or commence nectar secretion shortly before dawn, those for diurnal insects later in the day when it is warmer, and those specialised for pollination by bats or nocturnal moths at about dusk (Cruden *et al.* 1983, Bawa 1990). For example, the south-east Australian mistletoe *Amyema pendulum* has flowers with a narrow, tubular corolla such that the nectar is accessible only to birds, and nectar is secreted from dawn to about midday (Bernhardt & Calder 1981). In contrast, the Queensland rainforest tree *Syzygium cormiflorum* has a generalised pollination syndrome with open flowers, secretes nectar throughout the day and night and is pollinated by birds, blossom-bats and insects (Crome & Irvine 1986).

The Umbrella Tree *Schefflera actinophylla* is a small tree of tropical rainforests in Queens-

land, the Northern Territory and New Guinea. Its flowers attract a range of nectarivorous birds, as reported for both natural occurrences (Brown & Hopkins 1995, Franklin 1998) and plants in cultivation (Jones 1986, Brock 1993, Franklin 1998). Anecdotal observations, however, suggest that the Umbrella Tree is visited by birds mainly in the afternoon (Franklin 1998). The flowers of the Umbrella Tree are pink or red, a colour often associated with bird or butterfly pollination (Faegri & van der Pijl 1979). The flowers are apparently odourless, also characteristic of bird pollination syndromes. On the other hand, the large, robust and terminally-displayed inflorescences and small open flowers suggest adaptation to pollination by a range of animals and perhaps by bats in particular.

This combination of traits and patterns of usage raises questions about the pollinators and pollination adaptations of the Umbrella Tree. There appear to be no previous studies of the pollination biology of any species of *Schefflera*. In this note, I quantify temporal (daytime) patterns of use of the flowers of a single cultivated specimen during its 2000-01 flowering season. The specimen is the same tree that was the primary source of my earlier (1997-98 flowering season) observations. I also extend the consideration of vertebrate flower visitors by examining whether the late afternoon floral visitation is a prelude to evening visitation by flying foxes.

Methods

The study was conducted from 6 January to 19 February 2001, peak flowering time for the large (10 m tall) study specimen at Nightcliff (12° 23' S, 130° 51' E), a leafy, coastal suburb of Darwin. The specimen was growing in a well-treed home garden comprising a diverse mix of palm and non-palm tree species. Most observations were made on nine days dispersed throughout the study period, these observations being supplemented on other days throughout the study period to ensure more or less even coverage of all times of the day. I did not collect data if it was raining.

Observations consisting of instantaneous scan counts of the fauna feeding at the inflorescences were made on the hour in daylight hours. The scans were conducted from the second floor of a block of flats, which placed me at approximately eye level with, and about 30 m from the flowers, a good distance for observing birds but too far away to identify and frequently to even locate invertebrate visitors. I had a clear view of the majority of inflorescences, but some were partly obscured by foliage. I also counted the number of inflorescences in use.

The inflorescences were not visible after dark, being shaded from street lights. On 17 occasions (2000 hrs - 8 evenings; 2100 hrs - 7 evenings; 2200 hrs - 2 evenings) dispersed through the study period I listened for activity at the inflorescences and watched and listened for activity in nearby areas for 1 minute with the aim of detecting the

presence of flying foxes *Pteropus* spp.

Results

The Umbrella Tree produced about ten inflorescences during the study period, with generally between three and seven in use on a scan when vertebrates were foraging. Vertebrates were recorded feeding at these inflorescences during 40 of the 99 daylight scans. These records were, with one exception, entirely between 1400 and 1900 hours (Fig. 1), a time subsequently referred to as the *vertebrate activity period.*

The vertebrates recorded feeding at the Umbrella Tree flowers during daylight hours comprised one parrot, seven honeyeater and one flying fox species (Table 1). The White-gaped Honeyeater *Lichenostomus unicolor* was recorded both most frequently and most abundantly, followed by the Rainbow Lorikeet *Trichoglossus haematodus.* In addition to the two diurnal scan observations, I also observed a Black Flying Fox *Pteropus alecto* foraging at the flowers in daylight hours on two other occasions. These four observations were all of one individual, were on four different days, and occurred between 1650 and 1900 hours.

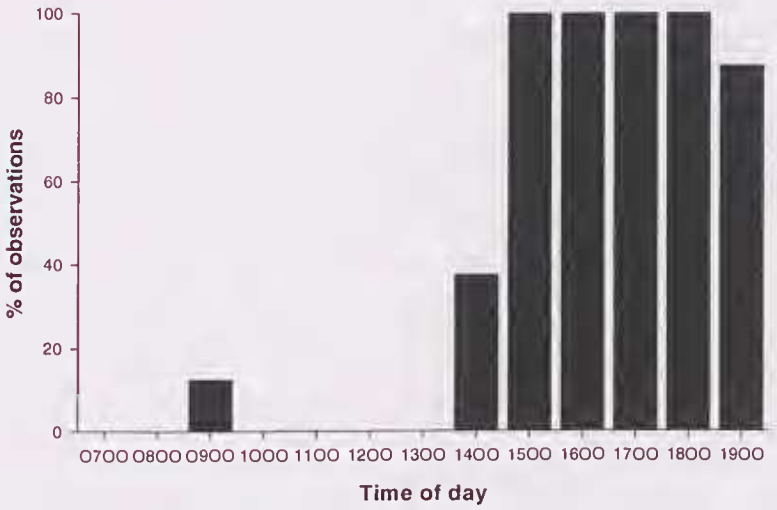

Figure 1. The diurnal distribution of vertebrate foraging at the flowers of an Umbrella Tree *Schefflera actinophylla* presented as the proportion of scans at which foraging vertebrates were present. The number of scans is eight at all times except 0700, 1600 and 1700 hours with 6 scans each, 0800 hours with 7 scans and 1200 and 1800 hours with 9 scans each.

Table 1. Vertebrates recorded feeding at the flowers of an Umbrella Tree *Schefflera actinophylla* during 99 daylight observations. The mean number of individuals is calculated for only those observations at which the species was present, to give an indication of group size.

	No. of observations	*Mean no. individuals*
Parrots		
Rainbow Lorikeet *Trichoglossus haematodus*	32	3.7
Honeyeaters		
Helmeted Friarbird *Philemon buceroides*	21	2.4
Little Friarbird *Philemon citreogularis*	17	1.9
Blue-faced Honeyeater *Entomyzon cyanotis*	2	2.0
White-gaped Honeyeater *Lichenostomus unicolor*	39	5.3
Brown Honeyeater *Lichmera indistincta*	22	1.8
Rufous-banded Honeyeater *Conopophila albogularis*	13	1.4
Dusky Honeyeater *Myzomela obscura*	9	1.1
Flying foxes		
Black Flying Fox *Pteropus alecto*	2	1.0

Foraging by honeyeaters consisted of rapid probing of flowers as if obtaining nectar, whereas that of the Rainbow Lorikeets and the Black Flying Fox was slow and methodical and I could not rule out pollen feeding as the main activity. Unfortunately, the inflorescences were inaccessible and could thus not be examined closely.

During the *vertebrate activity period*, average attendance at the Umbrella Tree at any instant was four species and 11 individuals. The aggregation of birds was commonly such that a small movement by one caused the displacement of another, and a size-based hierarchy was evident in which the smaller honeyeaters were almost constantly flying from inflorescence to inflorescence or to adjacent perches apparently awaiting foraging opportunities. The behaviour of the abundant White-gaped Honeyeaters in particular suggested *ad hoc* aggregation at a concentrated food source rather than any coordinated flocking behaviour. The sole vertebrate observation at the flowers outside the *vertebrate activity period* was of a single White-gaped Honeyeater feeding at 0900 hours.

Figure 1 suggests a distributional tail of activity at 1400 hours and perhaps also again at 1900 hours. On three days, four species of birds (a Rainbow Lorikeet and a Little Friarbird, one White-gaped Honeyeater and one Rufous-banded Honeyeater respec-

tively) were observed at 1400 hours to be sitting on the inflorescences but not feeding, a behaviour noted outside the *vertebrate activity period* on only two occasions.

I observed large invertebrates - butterflies or moths - at the flowers on only three occasions, once at 0900 hours and twice at 1200 hours. In each case there was only one individual involved. Because of the distance, I could not confirm that they were feeding nor identify the species.

In 17 nocturnal recording periods, there was no evidence of use of the Umbrella Tree flowers. That Black Flying Foxes were in the general area and therefore potentially able to make use of the blossom is indicated by the four daytime and three incidental nocturnal observations, well-spaced through the study period. I believe I would have detected groups of flying foxes because they interact noisily at nocturnal foraging sites, but could easily have missed solitary individuals.

Discussion

The timing of visits to flowers by animals can be influenced both by the timing of nectar secretion and by the activities and other priorities of the fauna involved. The remarkably consistent afternoon foraging by birds observed in this study, with activity commencing in the heat of the afternoon at *c.* 1400 hours and continuing for about five hours until close to sunset, runs counter to the general observation that bird activity is greatest (especially in hot climates) in the morning and secondarily in the late afternoon. The pattern of afternoon activity observed in this study is consistent with previous observations at this tree and opportunistic observations at other cultivated and one wild specimen (Franklin 1998 and unpubl. obs.). Brice Wells (pers. obs.) also noted that bird activity at a cultivated specimen in his Wanguri (Darwin) garden was consistently concentrated in the afternoon. These observations strongly suggest that bird activity at the flowers of Umbrella Tree is structured by the onset of nectar secretion in the early afternoon.

No foraging activity was identified after sunset, and although some such activity could have occurred undetected, clearly the flowers did not attract aggregations of flying foxes in the way that they had attracted aggregations of honeyeaters and lorikeets prior to sunset.

It seems, therefore, that the "strategy" of the Umbrella Tree is to attract birds as pollinators. Why then commence nectar secretion in the early afternoon when bird activity is normally at its lowest? Flowers of the hummingbird-pollinated iris *Rigidella flammea* open in the late afternoon (Cruden 1971), an even more unusual pattern. Cruden *et al.* (1983) suggested that aberrant diurnal patterns of flower-opening and/or nectar secretion could be an adaptation to avoid competition with other plant species for pollinators. This seems a plausible hypothesis for the evidently unusual pollination

biology of the Umbrella Tree, and one worthy of further investigation, ideally in the tree's natural rainforest habitat.

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References

Bawa K.S. (1990) Plant-pollinator interactions in tropical rain forests. *Annual Review of Ecology and Systematics* 21, 399-422.

Bernhardt P. and Calder D.M. (1981) The floral ecology of sympatric populations of *Amyema pendulum* and *Amyema quandang* (Loranthaceae). *Bulletin of the Torrey Botanical Club* 108, 213-230.

Brock J. (1993) *Native plants of northern Australia.* Reed, Chatswood, NSW.

Brown E.D. and Hopkins M.J.G. (1995) A test of pollinator specificity and morphological convergence between nectarivorous birds and rainforest tree flowers in New Guinea. *Oecologia* 103, 89-100.

Crome F.H.J. and Irvine A.K. (1986) "Two bob each way": the pollination and breeding system of the Australian rain forest tree *Syzygium cormiflorum* (Myrtaceae). *Biotropica* 18, 115-125.

Cruden R.W. (1971) The systematics of *Rigidella* (Iridaceae). *Brittonia* 23, 217-225.

Cruden R.W., Hermann S.M. and Peterson S. (1983) Patterns of nectar production and plant-pollinator coevolution. In *The biology of nectaries* (eds B. Bentley and T. Elias), pp. 80-125. Columbia University Press, New York.

Faegri K. and van der Pijl L. (1979) *The Principles of Pollination Ecology.* Pergamon Press, Oxford.

Franklin D. (1998) An avian smorgasbord. *Nature Territory* June 1998, 5.

Jones D.L. (1986) *Ornamental Rainforest Plants in Australia.* Reed, Frenchs Forest, NSW.